

List of claims

1. (cancelled) A valve comprising:

a valve body defining at least one supply passage, at least one drain passage a first device passage and a second device passage;

a valve member having a centerline and being at least partially positioned in said valve body and being movable along said centerline between a first position, a second position and a third position;

said valve member opening said supply passage to said first device passage at said first position, said valve member opening said first device passage and said second device passage to said drain passage at said second position, and said valve member opening said second device passage to said supply passage at said third position; and

at least one electrical actuator attached to said valve body and operably coupled to move said valve member.

2. (cancelled) The valve of claim 1 including at least one biaser operably coupled to bias said valve member toward said second position.

3. (cancelled) The valve of claim 2 wherein said at least one biaser includes a first spring and a second spring positioned in contact with opposite ends of said valve member;

said valve member having a first stop surface in contact with said valve body at said first position, and a second stop surface in contact with said valve body at said third position; and

said first stop surface and said second stop surface being out of contact with said valve body when said valve member is at said second position.

4. (cancelled) The valve of claim 1 wherein said valve member closing said first device passage and said second device passage to said supply passage at said second position.

5. (cancelled) The valve of claim 4 wherein said valve member defines at least one internal passage that fluidly connects said first device passage and said second device passage to said drain passage at said second position.

6. (cancelled) The valve of claim 1 wherein said valve member has a first end and a second end; and
said at least one electrical actuator includes a first solenoid coil attached to said valve body adjacent said first end, and a second solenoid coil attached to said valve body adjacent said second end.

7. (cancelled) The valve of claim 6 wherein said first solenoid coil and said second solenoid coil are parts of a single electrical circuit.

8. (cancelled) The valve of claim 7 wherein said at least one electrical actuator includes a first permanent magnet attached to said valve member adjacent said first solenoid coil, and a second permanent magnet attached to said valve member adjacent said second solenoid coil.

9. (cancelled) The valve of claim 1 including at least one biaser operably coupled to bias said valve member toward said second position;
said valve member closing said first device passage and said second device passage to said supply passage at said second position, and said valve member having a first end and a second end; and

said at least one electrical actuator includes a first solenoid coil attached to said valve body adjacent said first end, and a second solenoid coil attached to said valve body adjacent said second end.

10. (cancelled) A method of operating a hydraulic system, comprising the steps of:

connecting a source of high pressure fluid, a low pressure reservoir, a first hydraulic device and a second hydraulic device to a linear control valve;

activating said first hydraulic device at least in part by moving a portion of said linear control valve along a line to a first position that fluidly connects said first hydraulic device to said source of high pressure fluid;

deactivating said first hydraulic device and said second hydraulic device at least in part by moving said portion of said linear control valve along said line to a second position that fluidly connects said first hydraulic device and said second hydraulic device to said low pressure reservoir; and

activating said second hydraulic device at least in part by moving said portion of said linear control valve along said line to a third position that fluidly connects said second hydraulic device to said source of high pressure fluid.

11. (cancelled) The method of claim 10 including a step of biasing said linear control valve toward said second position.

12. (cancelled) The method of claim 10 wherein said step of activating said first hydraulic device includes a first step of energizing at least one electrical actuator; and

said step of activating said second hydraulic device includes a second step of energizing said at least one electrical actuator.

13. (cancelled) The method of claim 12 including a step of wiring said at least one actuator on a single electrical circuit; and

said first step of energizing includes a step of supplying current to said single electrical circuit in a first direction; and

said second step of energizing includes a step of supplying current to said single electrical circuit in a second direction that is opposite to said first direction.

14. (cancelled) The method of claim 10 wherein said step of activating said first hydraulic device includes a step of simultaneously pushing and pulling a valve member of said linear control valve in a first direction; and

said step of activating said second hydraulic device includes a step of simultaneously pushing and pulling said valve member in a second direction.

15. (cancelled) The method of claim 10 including a step of biasing said linear control valve toward said second position, which is a middle position;

said step of activating said first hydraulic device includes a step of magnetically pulling a valve member of said linear control valve in a first direction away from said middle position; and

said step of activating said second hydraulic device includes a step of magnetically pulling said valve member in a second direction away from said middle position.

16. (cancelled) An engine comprising:

an engine housing defining a plurality of cylinders;

a hydraulic system connected to said engine housing and including at least one source of high pressure fluid, at least one low pressure reservoir, at least one fuel injector and at

least one engine

compression release brake fluidly connected to at least one linear control valve; and

each said linear control valve having a portion movable along a line between a first position at which one fuel injector is fluidly connected to said source of high pressure fluid, a second position at which said one fuel injector and one engine compression release brake are fluidly connected to said low pressure reservoir, and a third position at which said one engine compression release brake is fluidly connected to said source of high pressure fluid.

17. (cancelled) The engine of claim 16 wherein each said linear control valve includes at least one biaser operably positioned to bias said portion toward said second position; and

each said linear control valve including at least one electrical actuator operably coupled to move said portion.

18. (cancelled) The engine of claim 17 wherein said portion is a valve member with a first end and a second end; and

each said linear control valve including a first solenoid coil positioned adjacent said first end, and a second solenoid coil positioned adjacent said second end.

19. (cancelled) The engine of claim 18 wherein said first solenoid coil and said second solenoid coil are portions of one electrical circuit.

20. (cancelled) The engine of claim 19 wherein each said linear control valve includes a first permanent magnet attached to said valve member adjacent said first solenoid coil, and a second permanent magnet attached to said valve member adjacent said second solenoid coil.

21. (new) A hydraulic system comprising:

a source of high pressure fluid;

a low pressure reservoir;

a fuel injector;

an engine compression release brake;

a control valve having a valve member that is movable along a line to stop at one of a first position, a second position and a third position, and being fluidly positioned between said source of high pressure fluid, said low pressure reservoir, said fuel injector and said engine compression release brake.

22. (new) The hydraulic system of claim 21 wherein said third position is located between said first position and said second position;

said fuel injector and said engine compression release brake being fluidly connected to said low pressure reservoir, but fluidly disconnected from said source of high pressure fluid, when said valve member is in said third position.

23. (new) The hydraulic system of claim 22 wherein said fuel injector is fluidly connected to, but said engine compression release brake is fluidly disconnected from, said source of high pressure fluid when said valve member is in said first position; and

said engine compression release brake is fluidly connected to, but said fuel injector is fluidly disconnected from, said source of high pressure fluid when said valve member is in said second position.

24. (new) The hydraulic system of claim 23 wherein said engine compression release brake is fluidly connected to said low pressure reservoir when said valve member is in said first position; and

said fuel injector is fluidly connected to said low pressure reservoir when said valve member is in said second position.

25. (new) The hydraulic system of claim 23 including at least one biaser operably coupled to bias said valve member toward said third position.

26. (new) The hydraulic system of claim 23 including first and second solenoid coils operably coupled to said valve member and being arranged in series in an electrical circuit; and

said valve member being attracted to said first solenoid coil and repulsed by said second solenoid coil when electric current flows in one direction through said electrical circuit; and

said valve member being repulsed by said first solenoid coil and attracted to said second solenoid coil when electric current flows in an opposite direction through said electric circuit.

27. (new) The hydraulic system of claim 26 wherein said valve member includes a first permanent magnet adjacent said first solenoid coil; and

said valve member includes a second permanent magnet adjacent said second solenoid coil.

28. (new) The hydraulic system of claim 21 wherein said valve member includes an internal passage disposed therein.

29. (new) The hydraulic system of claim 28 wherein said valve member includes opposite ends that are exposed to fluid pressure in said internal passage; and
said internal passage is fluidly connected to said low pressure reservoir.

30. (new) A method of operating a hydraulic system, comprising the steps of:
connecting a source of high pressure fluid, a low pressure reservoir, a fuel injector and an engine compression release brake to a control valve;

activating said fuel injector at least in part by moving a valve member of said control valve along a line to a first position that fluidly connects said fuel injector to said source of high pressure fluid;

activating said engine compression release brake at least in part by moving said valve member along said line to a second position that fluidly connects said engine compression release brake to said source of high pressure fluid; and

deactivating said fuel injector and said engine compression release brake at least in part by moving said valve member along said line to a third position that fluidly connects said fuel injector and said engine compression release brake to said low pressure reservoir.

31. (new) The method of claim 30 including a step of biasing said linear control valve toward said third position.

32. (new) The method of claim 30 wherein said step of moving a valve member to a first position includes a step simultaneously pushing said valve member with a first electrical actuator and pulling said valve member with a second electrical actuator; and

said step of moving said valve member to a second position includes a step of simultaneously pulling said valve member with said first electrical actuator and pushing said

valve member with said second electrical actuator.

33. (new) The method of claim 32 including a step of wiring said first and second electrical actuators in series on a single electrical circuit; and

said first step of energizing includes a step of supplying current to said single electrical circuit in a first direction; and

said second step of energizing includes a step of supplying current to said single electrical circuit in a second direction that is opposite to said first direction.

34. (new) The method of claim 30 including a step of biasing said control valve toward said third position, which is a middle position;

said step of activating said fuel injector includes a step of magnetically moving said valve member in a first direction away from said middle position; and

said step of activating said engine compression release brake includes a step of magnetically moving said valve member in a second direction away from said middle position.

35. (new) The method of claim 30 including a step of pressure balancing said valve member at least in part by exposing opposite ends of said valve member to pressure in an internal passage disposed in said valve member.

36. (new) An engine comprising:

an engine housing defining a plurality of cylinders;

a hydraulic system connected to said engine housing and including at least one source of high pressure fluid, at least one low pressure reservoir, a fuel injector for each of said cylinders and an engine compression release brake for at least a portion of said cylinders, and including a control valve for each of said cylinders having both a fuel injector and an engine

compression release brake; and

each said control valve having a valve member movable along a line between a first position at which one fuel injector is fluidly connected to said source of high pressure fluid, a second position at which one engine compression release brake is fluidly connected to said source of high pressure fluid, and a third position at which said fuel injector and said engine compression release brake are fluidly connected to said low pressure reservoir.

37. (new) The engine of claim 36 wherein each said control valve includes at least one biaser operably positioned to bias said valve member toward said third position; and

each said control valve including at least one electrical actuator operably coupled to move said valve member.

38. (new) The engine of claim 37 wherein said hydraulic system is fluidly connected to an engine lubrication system.

39. (new) The engine of claim 38 wherein said engine compression release brake includes a piston operably coupled to an engine brake valve member.

40. (new) The engine of claim 39 wherein each said fuel injector includes an intensifier piston.